Middle-East Journal of Scientific Research 22 (3): 368-370, 2014
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2014.22.03.21890

Essential Oil Composition of Leaves of *Juniperus phoenicea* Grown at Al-Jabel Al-Akhdar Region, Libya

[1]M.O. Alfitori, [2]S.H. Lamlom and [3]H.M. Aly

[1]Faculty of Natural Resources and Environmental Sciences,
University of Omar Al-Mukthar, Al-Baida, Libya
[2]Faculty of Arts and Science, University of Omar Al-Mukthar, Tobruk, Libya
[3]Faculty of Agriculture, University of Alexandria, Alexandria, Egypt

Abstract: The chemical composition of the essential oil obtained from the leaves of *Juniperus phoenicea* L. (Fam. Cupressaceae) was investigated. Samples were collected from Al-Jabel Al-Akhdar (Green Mountain) in the northeastern region of Libya. Hydro-distillation was performed to obtain the essential oils of the leaves while gas chromatography coupled with mass spectrometry system (GC/MS) was used for the analysis of their chemical composition. Thirty four (34) compounds were identified in essential oil representing 88.29% of the total oil composition. The major compound was identified as α-pinene (20.85%) followed by germacrene D (16.49%).

Key words: *Juniperus phoenicea* · Al-Jabel Al-Akhdar · Libya · Essential Oil · Hydro-Distillation · α-pinene · GC-MS

INTRODUCTION

Al-Jabel Al-Akhdar (Green Mountain) represents the study area of the present work. It is located immediately south of the coastal line in the north eastern region of Libya. It extends on the coast line to about 300 km and rises to about 881 meter above sea level [1].

J. phoenicea is a small tree that is native to the northern lands bordering the Mediterranean Sea from Portugal to Palestine. It is also native to North Africa found in Libya, Algeria, Morocco and Canary Islands [2]. This plant species is a conspicuous constituent of the vegetation of the Mediterranean basin, particularly in Al-Jabel Al-Akhdar region.

Detailed research on the chemical characteristics of this species has been performed [3, 4, 5, 6]. The composition of essential oils of the leaves of *J. phoenicea* has been reported in varying information from France [7, 8], Saudi Arabia [9], Greece and Spain [10], Algeria [11], Corsica [12] and from Morocco[13].

The essential oil content displays variations in plants from different geographical origin as well as from different parts of the tree. [5] studied the composition of *J. phoenicea* oil collected from Portugal, Spain and Greece. Their findings reported that the yields and the total oil obtained were 0.41% and 98.3%; 0.66% and 99% and 0.58% and 88%, respectively. The composition was likewise characterized by a high content of α-pinene (34.1%, 53.5% and 41.8%), β-phellandrene (19.2%, 5.9% and 3.5%) and β-caryophyllene (0.22%, 1.0% and 0.5%). In a study on the chemistry of Egyptian *J. phoenicea* [14], significant differences were detected in the essential oil composition between leaves and berries: α-pinene (38.22% and 39.30%), (α -cedrol 31.23% and sabinene 24.29%), respectively.

The current study determined the chemical composition of essential oils of leaves of *J. phoenicea* collected grown in the region of Al-Jabel Al-Akhdar in Libya. The collected data was then compared with those acquired from plants from different geographical origin.

MATERIALS AND METHODS

Plant Material: *J. phoenicea* leaves were collected from fully grown plants during March, 2009 from Al-Jabel Al-Akhdar. The collected leaves were dried in open air for fifteen days and were then preserved for extraction.

Corresponding Author: M.O. Alfitori, Faculty of Natural Resources and Environmental Sciences, University of Omar Al-Mukthar, Al-Baida, Libya.

Extraction of Essential Oils: The essential oil was extracted by hydro-distillation using an apparatus of Clevenger type according to methods previously utilized by [15] and [16]. The extraction process required roughly 2 or more hours for mixing 150 gm of leaves in 1000 mL of distilled water. The volatile oil was collected with water from the side tube and a small amount of diethyl ether was added in a separation funnel. The prepared volatile oils were then dehydrated over anhydrous sodium sulphate. Ether was then removed by using a rotary evaporator under vacuum air. Pure volatile oil was then obtained and stored at 4°C for analysis by Gas Liquid Chromatography Mass Spectrometry (GC/ MS).

Gas Liquid Chromatography / Mass Spectrometry: Gas Liquid Chromatography / Mass Spectrometry were performed at the Central Laboratory Unit / High Institute for Public Health, Alexandria University, Egypt after the completion of the aforementioned procedures. Samples were separated on a capillary column (30 m length, 0.25 mm of diameter and film thickness 0.25 ìm). The column temperature was programmed at temperatures ranging from 70 to 100°C for 2°C / min. and then increased to a maximum final temperature of 220°C for 6°C / min. The temperature of the injector was fixed to 240°C and for the detector to 260°C. Helium was used as carrier gas at a flow rate of 1.0 mL / min.

Identification of Compounds: Gas phase chromatography coupled with mass spectrometry (GC/MS) was used for the identification of different chemical constituents. The percentage of each constituent in the oil was determined by area peaks. Wiley mass spectral data base was used for identification of the separated peaks. The obtained compounds were identified by matching the mass spectra of the compounds with those recorded in MS library. Furthermore, this was verified by injecting the authentic samples of different available compounds with the volatile oil and by comparing the mass spectra with those of reference compounds or with the published data [17].

RESULTS AND DISCUSSION

The retention time of the different compounds in the essential oils of *J. phoenicea* are presented in Table 1. A total of thirty four volatile compounds, representing 88.29% of the total oil composition, were identified in the leaves oils (Table 1). Monoterpene hydrocarbons were found to be the major group of compounds. The most abundant component found in the leaf oil was α-pinene (20.85%) followed by Germacrene D (16.49%).

Table 1: The main components of essential oils of *Juniperus phoenicea* L. leaves from Al-Jabel Al-Akhdar, Libya

Constituents	Area %	*Rt (min)
α -pinene	20.85	4.16
β-myrcene	1.36	5.06
Terpinolene	0.07	5.26
β -phellandrene	3.84	5.91
Trans-Caryophyllene	5.44	14.66
4,7,10-Cycloundecatriene,1,1,4,8-tetramethyl-,cis,cis,cis-	5.31	15.37
Germacrene D	16.49	16.05
Germacrene B	2.73	17.46
α-cedrol	0.36	18.27
+. alpha.-longipinene	2.98	18.08
Naphthalene,1,2,3,4,4a,5,6,8a,-octahydro-7-methl-4-methylene-1-(1-methylethyl)-(1.alpha,4a.alpha.,8a.alpha)	5.22	16.23
camphene	0.29	4.32
β -pinene	0.49	4.81
1-phellandrene	0.39	5.33
delta.3-carene	0.40	5.46
α -terpinolene	0.23	7.10
terpinolene	5.13	13.11
Linalool	0.47	7.37
citronellol	0.63	10.30
α -cubebene	0.39	13.60
β -bourbonene	0.22	13.80
β -elemene	0.93	13.94
widdrene	1.24	14.83
α -gurjunene	0.35	16.40
zingiberene	0.43	16.92
delta.-cadinene	5.63	16.81
α -muurolene	0.43	17.01
α -calacorene	0.24	17.10
elemol	0.61	17.28
caryophyllene oxide	2.06	17.95
fonenol	0.36	18.58
. α -ylangene	1.33	19.03
β - selinene	0.30	19.54
vulgarol B	1.09	19.88

*Rt: Retention time obtained by chromatogram.

Our results are consistent with those obtained by [18] which identified that α-pinene and Germacrene D were among the main components of the essentials oils extracted from *Juniperus phoenicea* spp. Turbinate. The results were also consistent with those reported on the analysis of other juniper oils [10, 19] in which α-pinene was more common. [20] also confirmed that α-pinene was the most common component of the essential oil of *J. phoenicea* grown in Morocco and Tunisia, its percentage was 35.46-38.20 respectively. [21] stated that α-pinene was one of the major components for the essential oil of 68 *J. phoenicea* trees.

Although chemical characteristics has been conducted on this species [3, 4, 5, 6], additional research is still required to analyse the essential oils of this species in the studied region.

REFERENCES

1. El-Zwaam, S.M., 1995. Al-Jabel Al-Akhdar study of natural geography. Garyounis University Publications. Libyan National Library, Benghazi, pp: 139.
2. Gaussen, H., 1968. *Les Cupressacées Fasc. Xin Les Gymnospermes Actuelles et Fossiles*. Lab. Forest University Toulouse, France.
3. Afifi, M.S., S.H. El Sharkawy, G.T. Maatoog, M. El Sohly and J.P.N. Rosazza, 1992. Essential Oils of *Thuja occidentalis*, *Thuja orientalis*, *Cupressus sempervirens* and *Juniperus phoenice.* from the Mansoura. J. Pharm. Sci., 8: 37-46.
4. San Feliciano, A., D.C. Miguel, J.M. Gordaliza, M.A. Salinero and B. Del Rey, 1993. Acidic constituents of *Juniperus phoenice* subsp. Trobunata leaves. Fitotirapia., 64: 185-186.
5. Robert, P.A., A.F. Barrero and A. Lara, 1996. Comparisons of the Leaf Essential Oils of *Juniperus phoenicea*. J. Essent. Oil Res., 8: 367-371.
6. Adams, R.P., 2001. Identification of Essential Oil Components by Gas Chromatography/ Mass Spectrometry. Quadrupole, Allured Publication Corp, Carol Stream, Illinois.
7. Tabacik, C. and Y. LaPorte, 1971. Diterpenes of *Juniperus phoenicea*. Major Constituents. Phytochem., 10: 2147-2153
8. Tabacik, C. and C. Poison, 1971. Diterpenes of *Juniperus phoenicea*. Minor constituents. Phytochem., 10: 1639-1645
9. Dawidar, A.M., S.T. Ezmirly and M. Abdel-Mogib, 1991. Sesquiterpenes and diterpenes from *Juniperus phoenicea* L. Pharmazie., 46: 472-473.
10. Adams, R.P., A.F. Barrero and A. Lara. 1996. Comparisons of the leaf essential oils of *Juniperus phoenicea*, *J. phoenicea* subsp eu-mediterranea Lebr. and Thiv and *J. phoenicea* var. *turbinate* (Guss.) Parl. J. Essent. Oil Res., 8:1 367-371.
11. Bekhechi, C., B.F. Atik, D. Consiglio, A. Bighelli and F. Tomi. 2001. Chemical variability of the essential oil of *Juniperus phoenicea* var. turbinata from Algeria. Biochem. Syst. Ecol., 29(2): 179-188.
12. Rezzi, S., C. Cavaleiro, A. Bighelli, L. Salgueiro, AP. da Cunha and J. Casanova, 2011. Intraspecific chemical variability of the leaf essential oil of *Juniperus phoenicea* subsp. turbinata from Corsica. J. Food Sci., 76(2): C224-30.
13. Fouad, B., R. Abderrahmane, A. Youssef, H. Rajae and MA El Fels, 2012. Chemical composition and antibacterial activity of the essential oil of Moroccan *Juniperus phoenicea*. Food Res. International, 45(1): 313-319.
14. El-Sawi, S.A., H.M. Motawae and M.A. Amal, 2007. Chemical composition, cytotoxic activity and antimicrobial activity of essential oils of leaves and berries of *Juniperus phoenicea.* grown in Egypt. African J. Traditional Complementary Alternative Medicines, 4: 417-426.
15. Browning, B.L., 1967. Methods of Wood Chemistry. John Wiley and Sons. New York. London. Sydney, 1: 2.
16. Dob, T., T. Berramdane and C. Chelgoum. 2005. Chemical composition of essential oil of *Pinus halepensis* Miller growing in Algeria C. R. Chimie 8(11-12): 1939-1945.
17. Adams, R.P., Z. Shaozhen and C. Gelin. 1995. Essential oil of *Juniperus formosana* Hayata Leaves from China. J. of Essent. Oils Res., 7(6): 687-689.
18. Angioni, A., A. Barra, M.T. Russo, V. Coroneo, S. Dessi and P. Cabras. 2003. Chemical composition of the essential oils of *Juniperus* from ripe and unripe berries and leaves and their antimicrobial activity. J.Agric.Food Chem., 51(10): 3073-3078.
19. Adams, R.P., 1998. The leaf essential oils and chemotaxonomy of *Juniperus* sect. *Juniperus*. Biochem. Syst. Ecol., 26(6): 637-645.
20. Achak, N., A. Romane, A. Abbad, M. Ennajar, M. Romdhane and A. Abderrabba. 2008. Essential oil composition of *Juniperus phoenicea* from Morocco and Tunisia. J. Essent.Oil Bear. Plants, 11(2): 137-142.
21. Cavaleiro, C., S. Rezzi, L. Salgueiro, A. Bighelli, J. Casanova and A. Proenca Da Cunha, 2001. Infraspecific chemical variability of the leaf essential oil of *Juniperus phoenicea va*r.turbinata from Portugal. Biochem. Syst. Ecol., 29: 1175-1183.